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VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
 [AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
 Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 20007

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – JAN. 2025

Fourth Semester

Electrical and Electronics Engineering
 U19MA406 – NUMERICAL METHODS

(Regulation 2019)

Time : Three Hours

Maximum : 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO												
1.	Using fixed point iteration method, find the root between 0 and 1 of $e^x - 3x = 0$	2	K2	CO1												
2.	Compare Gauss – Jacobi and Gauss – Seidel methods for solving linear systems of the form $AX = B$.	2	K2	CO1												
3.	Why is interpolation used?	2	K3	CO2												
4.	Form the divided difference table for the following data	2	K2	CO2												
	<table border="1" style="margin-left: 20px;"> <tr> <td>X</td> <td>5</td> <td>7</td> <td>11</td> <td>13</td> <td>17</td> </tr> <tr> <td>Y</td> <td>150</td> <td>392</td> <td>1452</td> <td>2366</td> <td>5202</td> </tr> </table>	X	5	7	11	13	17	Y	150	392	1452	2366	5202			
X	5	7	11	13	17											
Y	150	392	1452	2366	5202											
5.	What is the formula for Romberg method?	2	K3	CO3												
6.	Evaluate $\int_{-1}^1 \frac{x^2}{1+x^4} dx$ by using three point Gaussian formula.	2	K3	CO3												
7.	Use Taylor's method to find $y(0.2)$ given , $\frac{dy}{dx} = x + y, y(0) = 1$.	2	K3	CO4												
8.	What is single step method and multi step method?	2	K2	CO4												
9.	Classify the PDE $u_{xx} + 4u_{xy} + (x^2 + 4y^2)u_{yy} = \sin(x + y)$.	2	K2	CO5												
10.	What is the central difference approximation for y'' ?	2	K2	CO5												

PART – B

(5 x 16 = 80 Marks)

- | Q.No. | Questions | Marks | KL | CO |
|-----------|--|-------|----|-----|
| 11. a) i. | Find the positive root of $3x = \text{Cos}x + 1$ correct to three decimal places | 8 | K3 | CO1 |
| ii. | Solve the system of equations by Gauss Jordan method.
$10x - 2y + 3z = 23$
$2x + 10y - 5z = -33$
$3x - 4y + 10z = 41$ | 8 | | |

(OR)

- | | | | | |
|-------|---|---|----|-----|
| b) i. | Using Power method, find the largest Eigen value and
$A = \begin{bmatrix} 2 & 1 & 0 \\ 1 & 2 & 1 \\ 0 & 1 & 2 \end{bmatrix}$ the corresponding Eigen vector of the matrix. | 8 | K3 | CO1 |
| ii. | Solve the following system of equations by Gauss – Seidel iteration method:
$10x - 5y - 2z = 3$
$4x - 10y + 3z = -3$
$x + 6y + 10z = -3$ | 8 | K3 | CO1 |

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|-----------|--|---|----|-----|
| 12. a) i. | From the following table of half-yearly premium for policies maturing at different ages, estimate the premium for policies maturing at age 46. | 8 | K3 | CO2 |
| | Age x : 45 50 55 60 65
Premium y : 114.84 96.16 83.32 74.48 68.48 | | | |
| ii. | Use Lagrange's formula to fit a polynomial to the data: | 8 | K3 | |

x :	-1	0	2	3
Y	-8	3	1	1

(OR)

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|----|---|----|----|-----|---|---|----|---|---|----|-----|--|--|--|
| b) | Obtain cubic spline for every subinterval from the given data | 16 | K3 | CO2 | | | | | | | | | | |
| | <table border="1"> <tbody> <tr> <td>x:</td> <td>0</td> <td>1</td> <td>2</td> <td>3</td> </tr> <tr> <td>y:</td> <td>1</td> <td>2</td> <td>33</td> <td>244</td> </tr> </tbody> </table> With end conditions $M_0=M_3=0$. Hence find $f(2.5)$ | x: | 0 | 1 | 2 | 3 | y: | 1 | 2 | 33 | 244 | | | |
| x: | 0 | 1 | 2 | 3 | | | | | | | | | | |
| y: | 1 | 2 | 33 | 244 | | | | | | | | | | |

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|-----------|---|---|----|-----|
| 13. a) i. | The population of a certain town is given below. Find the rate of growth of the population in 1931 and 1971 | 8 | K3 | CO3 |
|-----------|---|---|----|-----|

Year x	1931	1941	1951	1961	1971
Population in thousands	40.62	60.80	79.95	103.56	132.65

- | | | | | |
|-----|--|---|----|--|
| ii. | Use Trapezoidal rule to evaluate $I = \int_1^2 \int_1^2 \frac{xdy}{x+y}$ by taking $h=k=0.5$. | 8 | K3 | |
|-----|--|---|----|--|

(OR)

- b) i. Find the first two derivatives of y at $x=10$ from the following data: 8 K3 CO3

x:	3	5	7	9	11
y:	31	43	57	41	27

- ii. Compute $\int_1^2 \int_1^2 \frac{dx dy}{x^2+y^2}$ using trapezoidal rule with $h=0.2, k=0.25$ 8 K3

14. a) i. Solve $y' = 1 - y, y(0) = 1$ by Euler's method at $x = 0.1, 0.2, 0.3$ 8 K3 CO4
ii. Using Milne's method find $y(2)$ if $y(x)$ is the solution of 8 K3
 $\frac{dy}{dx} = \frac{1}{2}(x + y)$ given
 $y(0) = 2, y(0.5) = 2.636, y(1) = 3.595$ and $y(1.5) = 4.96$

(OR)

- b) Using R.K method of fourth order find $y(0.1)$ and $y(0.2)$ for the initial value problem $\frac{dy}{dx} = x + y^2, y(0) = 1$. 16 K3 CO4
15. a) Solve $u_{tt} = u_{xx}, 0 < x < 1, t > 0, u(0, t) = 0$ 16 K5 CO5
 $u(1, t) = 0$
 $u(x, 0) = x - x^2$
and $\frac{\partial u}{\partial t}(x, 0) = 0$, taking $h=0.2$ upto $h=1$.

(OR)

- b) Solve the Poisson's equation $\nabla^2(u) = -10(x^2 + y^2 + 10)$ over the square mesh with sides $x = y = 0; x = y = 3$ with $u = 0$ on the boundary and mesh length 1 unit. 16 K5 CO5